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ANATOMY OF GUYON'S CANAL — A SYSTEMATIC REVIEW

Abstract: Carpal tunnel syndrome is the first on the list of peripheral nerve lesions in the upper limb. Most of the anatomical facts about this syndrome are widely known. The Guyoun's canal is the second reason for compression syndrome in the wrist. Anatomy of this is region still remains controversial. This is why authors tried to compile some latest findings accompanied by their own observation, and added some clinical notes, which might be useful both for orthopedic surgeons and well as for representatives of basic sciences.

Key words: Guyon's canal, ulnar nerve, wrist, anatomy.

INTRODUCTION

Compression syndromes which affect peripheral nerves of the upper limb have been frequently discussed in current literature [1, 2]. Much of the reports deal with the studies based on anatomical dissection [3–7] considered to anatomical variation of structures traversing different canals or clinic-anthropological aspects [8, 9].

Canal of Guyon [10] is a fibro-osseous compartment localized at the ulnar side of palmar aspect of the wrist — which extends from proximal end of pisiform till the level of the hook of the hamate bone (Fig. 1).

The length of the canal is differently evaluated by different authors. Its shape changes on the transverse section depending on the course and location considering the surrounding structures. Considering it, its proximal part is triangular. The base of this triangle is directed toward the pisiform bone. In the median part canal is more oval or triangular, while in the distal portion is has a shape of biconcave lens [12] (Fig. 2).

Anterior wall of Guyon's canal is not homogenous [13]. Its proximal portion is created by palmar (volar) carpal ligament, which is an elongation of the superficial

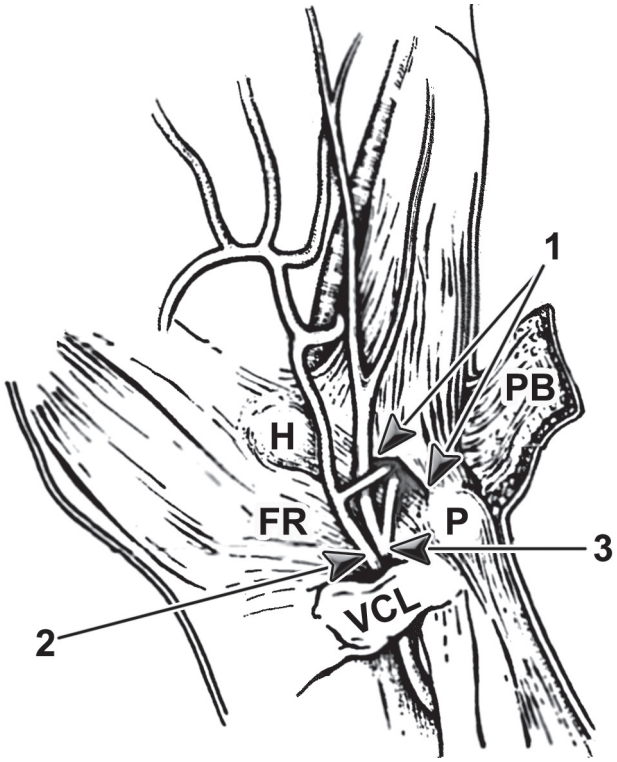

Fig. 1. Canal of Guyon — overview.

1 — pisohamate arch; 2 — ulnar artery; 3 — ulnar nerve; VCL — volar carpal ligament; FR — flexor retinaculum; H — hamate bone; P — pisiform bone; PB — palmaris brevis muscle. Adopted from Konig P.S. *et al.* [11].

lamina of antebrachial fascia. Histologically this ligament is composed of several layers and one can notice easy multidirectional orientation of its fibers. The spaces between the layers are filled with elastic connective tissue [14]. The median part of the "roof" of Guyon's canal fills adipose tissue. Distal fragment of anterior wall is made of palmaris brevis muscle, which attaches to flexor retinaculum and subcutaneous tissue of hypothenar region.

The floor of the canal, or dorsal wall includes flexor retinaculum, formerly known as transverse carpal ligament. It is attached to the pisiform and hamate bones, which form ulnar carpal eminence. The retinaculum is composed of fibrous connective tissue. It reminds the ligament with quite regular composition of compact collagen fibers [14]. The retinaculum forms also the roof of the canal (Fig. 3).

The medial wall of the canal is composed of the pisiform bone and the space located at the border between the medial and posterior wall, known as pisohamate hiatus. This hiatus is round and limited proximally by pisiform bone, distally by hook of the hamate bone; and dorsally by the pismohamate ligament

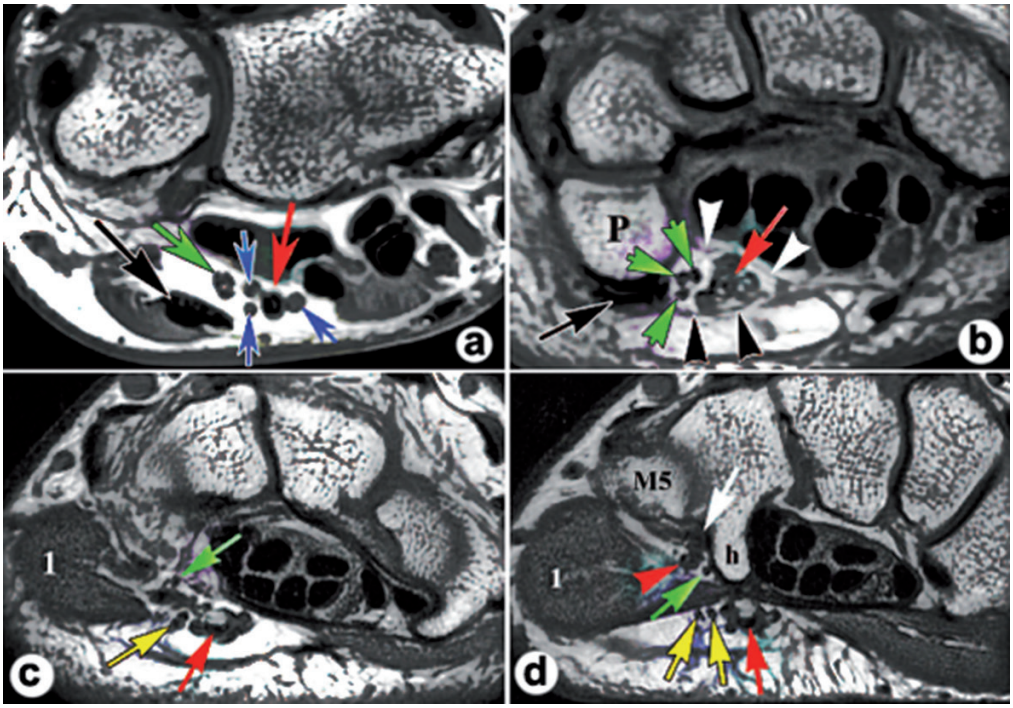

Fig. 2. Shape of canal of Guyon (after Blum AG *et al.*) [12].

a. proximal to the canal; green arrow — ulnar nerve, black arrow — tendon of flexor carpi ulnaris, blue arrow — ulnar veins, red arrow — ulnar artery

b. at the level of pisiform bone; green arrow — ulnar nerve, white arrowhead — flexor retinaculum, black arrowhead — palmar carpal ligament, red arrow — ulnar artery and comitant veins, P — pisiform bone

c. in the middle of the canal; green arrow — deep branch of ulnar nerve, yellow arrow — superficial branch of the ulnar nerve, red arrow — ulnar artery, 1 — abductor digiti minimi

d — on the level of the hook of hamate; green arrow — deep branch of ulnar nerve, red arrowhead — deep branch of ulnar artery, yellow arrow — proper palmar digital nerve of little finger, medial and palmar common digital nerve of anular and little fingers, red arrow — ulnar artery, h — hook of hamate bone, M5 — fifth metacarpal bone.

which strengthens the articular capsule. Palmar aspect of the hiatus is limited by attachments and bellies of the hypothenar muscles, abductor digiti minimi and the flexor digiti minimi brevis. This attachment has commonly a form of tendinuous arch which extends between the pisiform and the hook of hamate [15] (Fig. 4).

The contents of Guyon's canal known in the literature as ulnar neurovascular space of the wrist or distal ulnar tunnel, also pisohamate tunnel [13] are consisted of ulnar nerve and its branches, ulnar artery and predominantly two comitant veins and lymphatic vessels. There are also significant numerous anastomoses between the ulnar and median nerves. Final subdivision of ulnar nerve is of three main types.

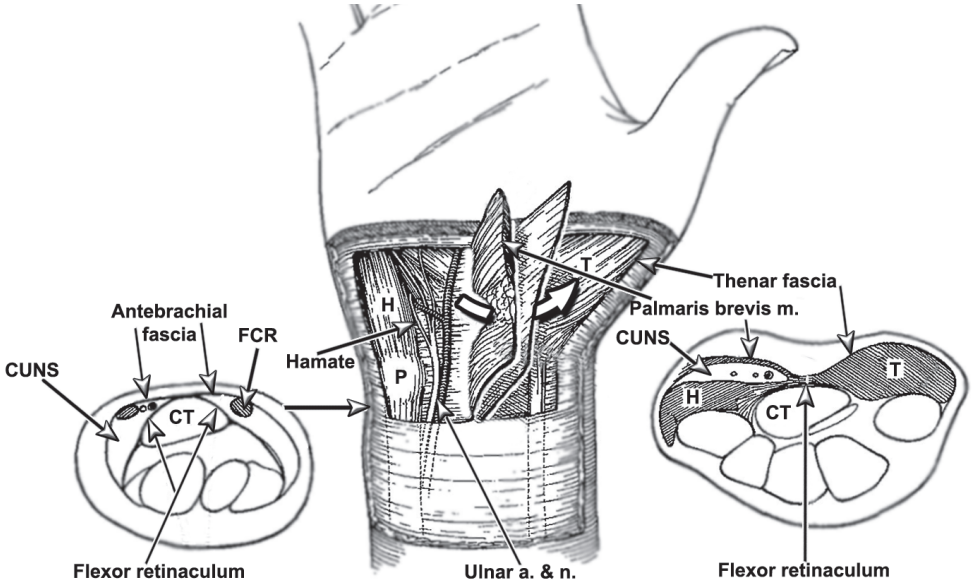

Fig. 3. Canal of Guyon. Arrows indicate section levels. The roof of the canal has been removed and elevated on the ulnar side.

FCR — flexor carpi radialis tendon; P — pisiform bone; T — thenar muscles; H — hamate bone; CUNS — carpal ulnar neurovascular space — Guyon's canal; CT — carpal tunnel — after Cobb TK *et al.* [13].

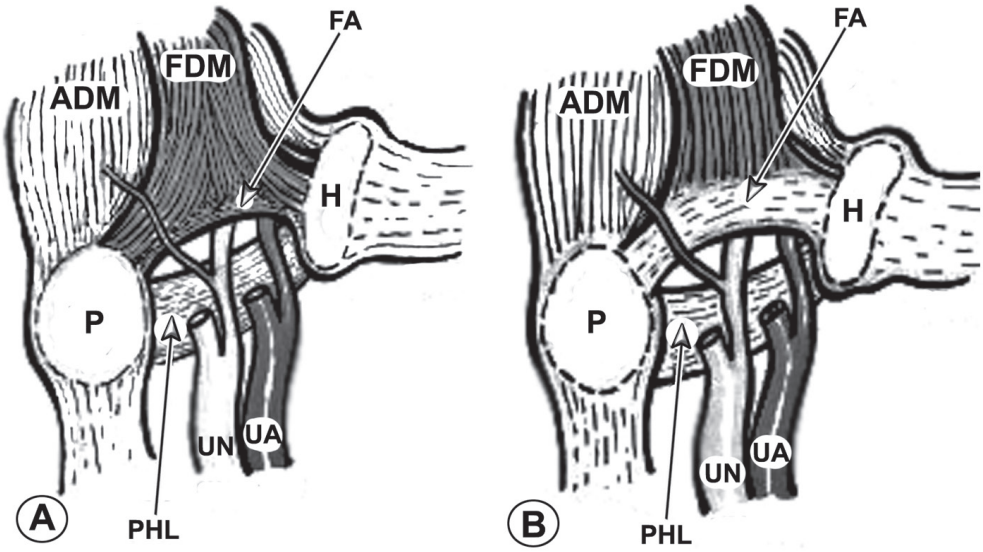

Fig. 4 — Composition of the pisohamate tendinous arch — after Bozkurt M.C. *et al.* [16].

A — muscular form; B — fibrous form; ADM — abductor digiti minimi, FDM — flexor digiti minimi brevis, P — pisiform bone, H — hamate bone, FA — pisohamate arch, PHL — pisohamate ligament, UN — ulnar nerve, UA — ulnar artery

CONCLUSION

Bearing in mind of three types of ulnar nerve final division pattern and presence of cutaneous branches during diagnosis and surgical treatment of Guyon's canal syndrome will allow to avoid diagnostic mistakes and therapeutic failures. Surgeon should always visualize and decompress all branches of ulnar nerve. Obtained results of microscopic nerve measurements may work as a base data in creating reference values for ultrasonography diagnostic tests.

CONFLICT OF INTERESTS

None declared.

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